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DOOR INTERLOCKING SYSTEM

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BACKGROUND OF THE INVENTION

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The invention relates to improvements in elevator landing door assemblies and, more particularly, to a position control mechanism for multiple horizontal sliding door panels.

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PRIOR ART

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Freight elevator landing doors of the multiple panel, horizontal sliding type typically have a device to produce simultaneous movement of the panels. A common type of control device uses a cable and pulley system to produce the desired movement rate and distance which, as between the panels are typically different but proportional.

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Conventional cable systems are prone to go out of adjustment due to permanent stretching of the cables and/or wear of related parts. Generally, the cable systems are disposed above the door panels thereby making their original installation as well as subsequent service adjustments awkward, tedious and time-consuming.

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SUMMARY OF THE INVENTION

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The invention provides a multi-panel motion control system for a freight elevator door landing having a simplified linkage arrangement that is easy to install, requires minimal initial adjustment, and is resistant to wear or other distortion effects that require periodic adjustment or replacement. The linkage of the invention is adapted to be mounted at mid-height on the door panels so that it can be easily installed and adjusted by a technician conveniently working on the level of the respective landing.

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Preferably, the linkage is in a multiple scissors or X-like configuration so that the forces on individual

1 links and pivot connections or pins are balanced and
2 relatively low forces are imposed on the linkage.
3 Consequently, the linkage has the potential of operating
4 over an extended service life with a minimum of wear, and
5 thereby reduces the need for periodic service adjustment
6 or replacement. Mounting brackets for the linkage can be
7 directly secured to the panels and minimum initial
8 adjustment is required. While a pinching hazard at the
9 linkage is remote because in operation the linkage is
10 ordinarily shielded by the elevator car door, the
11 mechanism can include shields to minimize the risk of
12 personal injury or mechanical damage when the linkage is
13 exposed during periodic inspection or maintenance.

14 BRIEF DESCRIPTION OF THE DRAWINGS

15 FIG. 1 is an elevational view from the inside of the
16 elevator shaft of a door position control system
17 constructed in accordance with the invention shown with
18 associated door panels in a closed position;

19 FIG. 2 is a view similar to FIG. 1, with the door
20 panels and position control system in an open position;

21 FIG. 3 is an elevational edge view of the control
22 system and door panels from a vantage point lateral of
23 the shaft opening; and

24 FIG. 4 is a plan view of the door control system and
25 door panels in an open position.

26 DESCRIPTION OF THE PREFERRED EMBODIMENT

27 An assembly 10 of horizontal sliding door panels 11a
28 - 11c, is illustrated in the figures. The panels 11, for
29 example, represent the right side of a six-panel door
30 assembly. The left side of the assembly is symmetrical
31 with and a mirror image of FIGS. 1 and 2. The panels 11
32 are supported on traction rollers 12 supported on
33 overhead tracks 13 in a generally conventional manner.

1 The door panel assembly 10, as is typical, exists to
2 close the shaft opening at a respective landing when an
3 elevator car is elsewhere and opens for ingress and
4 egress to the car when the car is present at the landing.
5 The panels 11, as seen most clearly in FIGS. 3 and 4, are
6 horizontally spaced or in staggered vertical planes so
7 that they are able to register one behind the other as
8 shown in FIG. 4 when in the open position.

9 When the panels 11 move between their respective
10 open and closed positions, it is desirable that they all
11 depart from and arrive at these positions at the same
12 time. It follows that the inner door 11a, i.e. the door
13 that is spaced farthest from the shaft wall, must move
14 the farthest and, therefore, the fastest, from and
15 towards the center line of the shaft opening (or if the
16 entire door assembly comprises only three panels, to the
17 opposite side of the opening). The position and rate of
18 travel of the door panels 11 in accordance with the
19 present invention, is controlled by a linkage assembly or
20 system 16. The assembly 16 comprises a series of
21 individual links pivotally connected to one another, to
22 the panels 11, and to a fixed referenced member or end
23 bracket 17. The links 18, 19 are substantially uniform
24 in length being either a short length or a long length,
25 respectively, the latter being substantially equal to
26 twice the short length. The short length links 18 have
27 operative pivot connections only at their ends, while the
28 long length links 19 have operative pivot connections at
29 their ends and at their mid-lengths so that they form an
30 X or scissors-like configuration with other links 19. As
31 shown, the links 18, 19 are proportioned so that in
32 relation to the width of the door panels 11 such that
33 when the panels are in the closed position of FIG. 1,
34 they are inclined from the horizontal by a substantial
35 angle preferably at least about 30° so that high

1 compressive forces along the axis of the links are
2 avoided and the linkage 16 operates smoothly. The door
3 panel 11c, at the right in FIG. 1, i.e. the door required
4 to move the least distance between open and closed
5 positions, is referred to as the slow door panel; the
6 door panel 11a at the left in FIG. 1, i.e. the door panel
7 required to move the greatest distance between open and
8 closed positions, is referred to as the fast door panel;
9 and the door panel 11b, in between, is referred to as the
10 middle door panel.

11 The linkage assembly 16 comprises a series of nodes
12 21 - 23 corresponding to the number of sliding door
13 panels it controls. The nodes 21, 23 associated with the
14 slow and fast doors, respectively, comprise short links
15 18 and portions of long links 19, while the intermediate
16 or middle panel 11b has its node comprised of portions of
17 long links 19.

18 The end bracket 17 provides a fixed reference point
19 for the linkage system 16. The bracket 17 is fixed by
20 bolts to a rigid strut 24 or other stationary member
21 spaced laterally of the landing opening. The slow and
22 middle door panels 11c, 11b, have associated L-shaped
23 brackets 26, 27, as viewed in the plan view of FIG. 4,
24 screwed to vertical edges 28 of their respective door
25 panels. The fast door panel 11a has a bracket 29
26 attached to its side facing the shaft. This fast door
27 panel bracket 29 carrying a pivot pin 30 is horizontally
28 adjustable on the panel 11a by virtue of slots 31
29 receiving screws attaching it to the panel. At the other
30 end of the linkage 16, a pivot pin 32 in the form of a
31 shoulder bolt, is horizontally adjustable in a slot 33 in
32 the bracket 17. The slow and middle door panel brackets
33 26, 27 support pivot pins 35.

34 As shown in FIGS. 1 and 2, the ends of the links
35 remote from the bracket pins 30, 32, 35, are each

1 pivotally connected to one or two link ends by common
2 pins. The links 18, 19 are assembled on the bracket pins
3 30, 32, 35 and, as shown in FIG. 4, the pins are arranged
4 to support the links in three closely spaced parallel,
5 vertical planes. Alternate links are doubled (going from
6 left or right in FIGS. 1 and 2, above or below the
7 bracket pins) to straddle intervening single links. This
8 straddling of intervening single links with double links
9 tends to balance the operating forces on the links and
10 pins and, thereby, avoids excessive eccentric loading on
11 the parts and wear which would otherwise be attendant to
12 such eccentric loading.

13 The slow, middle and end brackets 26, 27 and 17, are
14 configured with pivot pin supporting legs 36, 37, 38 that
15 lie generally in a common vertical plane with the bracket
16 29 parallel to the door panels 11. To accomplish this,
17 the slow and middle brackets 26, 27, have legs 41, 42
18 perpendicular to these pin supporting legs 36, 37 of
19 different lengths, each sufficient to reach the edges of
20 their respective door panels to which they are attached
21 by suitable screws. Additionally, the pivot pin
22 supporting legs 36, 37 are U-shaped so that the end
23 bracket leg 38 can nest in the slow bracket leg 36, and
24 the slow bracket leg 36 can nest in the middle bracket
25 leg 37.

26 It can be seen that the pivot pin supporting bracket
27 29 on the fast door panel 11a is horizontally adjustable
28 with slots 31 that accept screws that fix it to this door
29 panel. The horizontal adjustability of the shoulder bolt
30 32 on the end bracket 17 and the fast bracket 29 enables
31 the linkage 16 to be adjusted so that in the open
32 position, the door panels 11 can be aligned with the
33 landing opening frame.

34 A set of guards 46 is mounted on the linkage 16 to
35 reduce the already limited risk that a serviceman's hand

1 or tools might be pinched between the links 18, 19 when
2 the door panels are being opened. The guards can be in
3 the form of sheet metal or plastic strips that are
4 assembled on pivot pins 47 coupling the ends of the links
5 remote from the bracket pins 30, 32, 35. The guards 46
6 are U-shaped when viewed from the edge in FIG. 3. This
7 U-shaped configuration, with both vertical parts of the
8 guard 46 pivoted on a respective pin 47, allows the guard
9 to be relatively stiff so that it remains in a vertical
10 plane. The illustrated curved profiles of the brackets
11 17, 26 and 27 also reduce the risk of a pinching hazard.

12 It should be evident that this disclosure is by way
13 of example and that various changes may be made by
14 adding, modifying or eliminating details without
15 departing from the fair scope of the teaching contained
16 in this disclosure. The invention is therefore not
17 limited to particular details of this disclosure except
18 to the extent that the following claims are necessarily
19 so limited.

WHAT IS CLAIMED IS:

1 1. A landing door for a freight elevator comprising
2 a plurality of horizontally sliding door panels of
3 generally the same width, and a multiple node scissors
4 linkage for controlling the simultaneous movement of the
5 panels between open and closed positions, the panels
6 having their left and right vertical edges respectively
7 substantially aligned with one another when the panels
8 are in an open position and having right and left edges
9 of proximal panels adjacent one another when the panels
10 are in a closed position, said linkage including long
11 links having pivots at their operative ends and at their
12 operative centers, said long links having lengths greater
13 than the width of the door panels and being arranged such
14 that in the closed position of the panels, said long
15 links are substantially inclined from a horizontal plane.

1 2. A landing door as set forth in claim 1, wherein
2 said linkage includes short links having operative
3 lengths generally equal to one-half the operative length
4 of said long length links.

1 3. A landing door as set forth in claim 2, wherein
2 said links lie in vertical planes that are all adjacent
3 one of said panels that travels the greatest distance
4 between the open and closed positions of said panels.

1 4. A landing door as set forth in claim 1, wherein
2 said linkage is vertically situated between the top and
3 bottom of said panels.

1 5. A landing door as set forth in claim 4, wherein
2 said links are arranged in pairs that straddle a single
3 link.

1 6. A landing door as set forth in claim 5, wherein
2 said links are connected to said door panels with
3 brackets that extend from vertical edges of said door
4 panels.

1 7. A landing door as set forth in claim 6, wherein
2 said brackets have pivot pins spaced horizontally from
3 both vertical edges of their respective door panels.

1 8. A landing door as set forth in claim 7, wherein
2 said links of said linkage are all symmetrically arranged
3 in pairs or individually about a common vertical plane
4 spaced towards the shaft from all of said panels.

1 9. A freight elevator landing door assembly
2 comprising a plurality of horizontal sliding door panels,
3 multiple node scissors linkage for controlling the
4 simultaneous movement of the door panels, said linkage
5 comprising a plurality of links disposed in pairs or
6 individually symmetrically about a common plane on a
7 shaft side of the door panels, the linkage being disposed
8 at an elevation between the lower and upper ends of the
9 door panels.

1 10. A freight elevator landing door assembly as set
2 forth in claim 9, wherein some of said links have
3 operative lengths that are substantially greater than the
4 width of the door panels.

1 11. A freight elevator landing door assembly as set
2 forth in claim 9, including offset brackets attached to
3 said door panels, said offset brackets supporting said
4 linkage in said common plane.

1 12. A freight elevator landing door assembly as set
2 forth in claim 11, wherein said brackets are secured to
3 vertical edges of said door panels.

1 13. A freight elevator landing door assembly as set
2 forth in claim 12, wherein said brackets have an L-shaped
3 configuration in plan view.

1 14. A freight elevator landing door assembly as set
2 forth in claim 9, wherein said door panels have
3 substantially the same width.

1 15. A freight elevator landing door assembly as set
2 forth in claim 11, wherein said brackets support pivot
3 pins that pivotally support long links at their
4 operational centers.

1 16. A freight elevator landing door assembly as set
2 forth in claim 15, wherein said brackets have
3 configurations which enable portions of said brackets to
4 nest within one another in a plane parallel to said
5 common plane.